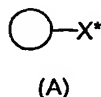



## CLAIMS

1. A process for the production of chiral ligands comprising providing a starting material of Formula (A):



5 wherein X\* is a chiral or achiral directing group; and

 is an optionally substituted mono- or polycyclic aryl or cycloalkyl group; ortholithiating the substrate; converting the ortho-lithiated substrate to a phosphine group having the formula  $-PR^1R^{1'}$ ,  $R^1$  and  $R^{1'}$  being different from each other and independently selected from substituted and unsubstituted,

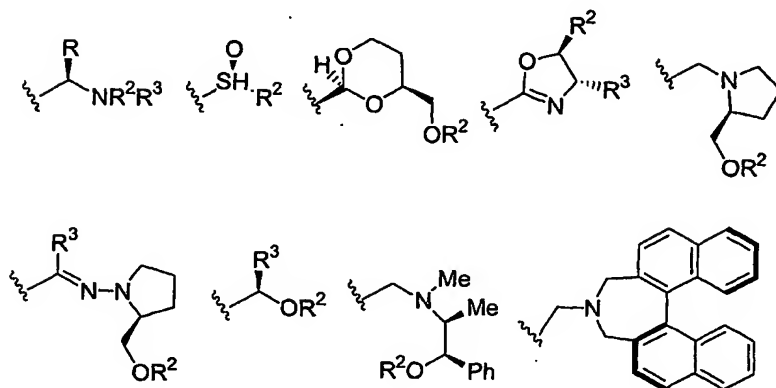
10 branched- and straight-chain alkyl, alkoxy, alkylamino, substituted and unsubstituted cycloalkyl, substituted and unsubstituted cycloalkoxy, substituted and unsubstituted cycloalkylamino, substituted and unsubstituted carbocyclic aryl, substituted and unsubstituted carbocyclic aryloxy, substituted and unsubstituted heteroaryl, substituted and unsubstituted heteroaryloxy,

15 substituted and unsubstituted carbocyclic arylamino and substituted and unsubstituted heteroarylamine, wherein the or each heteroatom is independently selected from sulphur, nitrogen, and oxygen; and optionally or if necessary converting X\* to a different grouping to produce a chiral ligand.

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2. A process according to claim 1 wherein X\* is a chiral directing group and the ortholithiation is enantioselective.

3. A process according to claim 3 wherein X\* is selected from:



Wherein R, R<sup>2</sup> and R<sup>3</sup> are independently selected from substituted and unsubstituted, branched- and straight-chain alkyl, substituted and unsubstituted cycloalkyl, substituted and unsubstituted carbocyclic aryl, and substituted and unsubstituted heteroaryl wherein the or each heteroatom is independently selected from sulphur, nitrogen, and oxygen.


4. A process according to any one of claims 1 to 3 wherein X\* is an achiral directing group and the ortholithiation proceeds in the presence of a chiral auxiliary and is enantioselective.

5. A process according to claim 4 wherein X\* is selected from:



- Wherein R<sup>2</sup> and R<sup>3</sup> are independently selected from substituted and unsubstituted, branched- and straight-chain alkyl, substituted and unsubstituted cycloalkyl, substituted and unsubstituted carbocyclic aryl, and substituted and

unsubstituted heteroaryl wherein the or each heteroatom is independently selected from sulphur, nitrogen, and oxygen.

6. A process according to any one of claims 1 to 5 wherein  is one,  
5 optionally further substituted, aromatic ring of a metallocene compound.
7. A process according to any one of claims 1 to 6 wherein X\* is an ortho directing group.
- 10 8. A process according to any one of claims 1 to 7 comprising reacting the ortholithiated substrate with an R<sup>1</sup> substituted phosphine or arsine to form an intermediate compound.
9. A process according to claim 8 comprising reacting the intermediate  
15 compound with an R<sup>1</sup>-bearing Grignard reagent or organolithium compound.
10. A ligand obtainable by a process according to any one of claims 1 to 9.
11. A ligand according to claim 10 obtained by a process according to any  
20 one of claims 1 to 9.
12. A transition metal complex catalyst incorporating at least one ligand according to claim 10 or claim 11.

13. Use of the transition metal complex catalyst of claim 12 in asymmetric catalysis.